

PREFACE

A continuous, dependable supply of mineral resources is essential to the economic strength of the United States. In our industrial society these non-renewable resources are the physical base from which most goods are manufactured. Recently the domestic discovery and production of new mineral deposits has slowed due to many factors, including high cost and environmental constraints. Most of the obvious near-surface ore deposits have been found, which has led integrated exploration programs to look deeper or in areas that are under cover. Geophysical methods provide an important advantage in this search for undiscovered mineral deposits. Effective use of integrated geophysical data allows a three dimensional picture of the subsurface yet data acquisition usually leaves the surface undisturbed.

Geophysical methods are based on the measurement of natural and artificial fields that are influenced by the distribution of rocks that have varying physical properties. Knowledge of the physical properties of various rock types and minerals is a prerequisite to successful interpretation using geophysical techniques. A wide variety of valuable information may be acquired by the selection and application of the appropriate geophysical techniques, along with an understanding of the regional and deposit-scale geophysical characteristics of mineral deposits.

The application of geophysics begins at the reconnaissance stage or regional scale, where remote sensing and airborne methods serve to outline broad geologic features or favorable terrain. In the detailed follow-up stage a variety of ground methods are directed at finding targets. The final stage might utilize down-hole techniques or underground surveys to define an orebody or additional reserves. Several geophysical methods can be applied and results integrated for direct detection of ore bodies, indirect detection of characteristic geologic features, or as an aid to geologic mapping.

Assessments of federal lands emphasize the evaluation of large tracts of land for potential resources of all commodities that might occur. This process is interdisciplinary and geologic, geochemical, and geophysical data must be integrated to ascertain if there is evidence of mineralization within the area of study. Geophysical data are integrated into the assessment process at various levels depending on the scale or desired resolution. Regional geophysical data sets such as aeromagnetic, gamma-ray, and gravity are readily available but may be sparse in coverage. Deposit scale geophysical surveys on certain deposit types are numerous, but acquisition of such data has waned (domestically) in recent years, and many data sets are contained in proprietary company files.

A descriptive mineral deposit model, such as given by Cox and Singer (1986), is a list of regional and local characteristics covering geology, mineralogy and geochemistry. The geophysical characteristics compiled here are an important component of the continuously evolving deposit model and therefore complement these previously published characteristics. The purpose of the geophysical model is to provide, where possible, quantitative values of physical properties and their ranges, in order to permit quantitative modeling of the geophysical response. The ultimate function of ore deposit models is to use the geologic, geochemical and geophysical characteristics to unravel the genesis and to better predict the location of new deposits. This then leads to more accurate mineral resource assessments and successful exploration programs.

W. D. Heran